

The channel probe 590 connects to the links 512 and 514. The configuration and operation of the channel probe 590 is discussed in further detail in FIGS. 14-16. The RMON probe 595 connects to the link 511. The configuration and operation of the RMON probe 595 is discussed in further detail in FIGS. 22-24.

The head end 500 operates as follows. The head end 500 communicates with the market hub 400 and the customer premises 600. The downstream manager 520 routes data to the customer premises 600. The data could be from other components in the broadband wireless system 100. The downstream manager 520 communicates with the other components through the switch 510 and the router 505. The operation of the router 505 and the switch 510 is well known to those skilled in the art and is not discussed for the sake of brevity.

The downstream manager 520 receives packets that contain the data from the switch 510 over the link 513. The downstream manager 520 processes the packets to extract the data. The downstream manager 520 converts the data into an IF signal. The downstream manager 520 transmits the IF signal to the transmitter system 535 through the patch panel 525 over the links 516 and 528. The up-converter 560 and the transmitter 565 function together to process the IF signal and convert the IF signal into an RF signal. The transmitter system 535 then transmits the RF signal to the transmitter antenna 570 over the link 531.

The transmitter antenna 570 is an omni-directional antenna. The transmitter antenna 570 transmits the RF signal to the customer premises 600 on downstream channels over the link 129. The RF signal is a Multichannel Multipoint Distribution Service (MMDS) signal. The MMDS frequencies range from 2596 MHz to 2644 MHz. The MMDS signals in this example also include the Multipoint Distribution Service (MDS) frequencies. The MDS frequencies comprise MDS1 (2150-2156 MHz) and MDS2 (2156-2162 MHz). The bandwidth of the downstream channels is approximately 8 Mbps.

Concurrently, the upstream manager 515 routes data received from the customer premises 600 to the broadband wireless system 100. The upstream

manager 515 communicates with other components in the broadband wireless system 100 through the switch 510 and the router 505.

The upstream manager 515 receives the data from the customer premises 600 through the receiver system 530 and the receiver antenna 575. The receiver antenna 575 is a directional antenna. The receiver antenna 575 forms a "sector" in the direction in which it points. Any communication device that communicates with the receiver antenna 575 is considered within the sector. Those skilled in the art will appreciate that the base antenna 540 could include a plurality of receiver antennas forming a plurality of sectors. Those skilled in the art will also appreciate that the head end 500 could include a plurality of upstream managers and receiver systems depending on the number of sectors controlled by the head end 500.

The receiver antenna 575 receives an RF signal from the customer premises 600 on the upstream channel over the link 128. The RF signal is also an MMDS signal. The bandwidth of the upstream channel is approximately 200 kbps.

The receiver antenna 575 transfers the RF signal over the link 521 to the receiver system 530. The LNA 555 amplifies the RF signal. The receiver 550 and the down-converter 545 function together to process the amplified RF signal and convert the amplified RF signal into an IF signal. The receiver system 530 transfers the IF signal to the upstream manager 515 through the patch panel 525 over the links 517 and 514. The patch panel 525 connects many devices together. For instance, if the head end 500 controlled ten sectors, then the patch panel 525 would connect ten upstream managers to ten receiver systems.

The upstream manager 515 receives the IF signal through the patch panel 525. The upstream manager 515 processes the IF signal to route the data carried by the IF signal. The upstream manager 515 generates packets and inserts the data, carried by the IF signal, into the packets. The upstream manager 515 transmits the packets to the switch 510 for transmission to other components in the broadband wireless system 100.

The upstream manager 515 also generates control messages for the customer premises 600. The upstream manager 515 transmits these control messages to the downstream manager 520 through the switch 510. The downstream manager 520 transmits the control messages to a wireless  
5 broadband router that is located at the customer premises 600. The wireless broadband router communicates with the upstream manager and the downstream manager to exchange data.

The upstream manager 515 separates the upstream channels into subchannels. The upstream manager 515 polls numerous wireless broadband  
10 routers to allocate use of subchannels. Polling is a round robin process to determine which wireless broadband router has access to a subchannel. The upstream manager 515 maintains a queue of the active wireless broadband routers to determine which wireless broadband router is next to transmit over a subchannel for a period of time.

The upstream manager uses the control messages to grant a wireless  
15 broadband router use of a subchannel for a limited period of time. The control messages are credits. A credit is a message that allows usage of a subchannel for a period of time or for the transfer of a maximum number of transmission units such as bytes. One example of a credit includes information such as a  
20 subchannel or frequency range, a maximum allowed time to transfer data, and a maximum number of bytes the wireless broadband router is allowed to transfer.

There are two kinds of credits: polling and dedicated. Polling credits are credits related to polling of the wireless broadband routers. Polling credits are generally smaller than the dedicated credits. Once the wireless broadband  
25 router completes transfer of the packets, the wireless broadband router transmits a DONE message to the upstream manager 515 via the upstream channels. The DONE messages include information such as the number of bytes sent and the number of packets left for the wireless broadband router to transfer. If the DONE message shows that the wireless broadband router has more than three packets  
30 left to transfer and there are available subchannels, then the upstream manager 515 issues a dedicated credit to the wireless broadband router.